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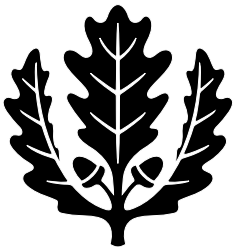
Thomas J. Miceli
University of Connecticut

Kathleen Segerson
University of Connecticut



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Thomas J. Miceli
University of Connecticut

Kathleen Segerson
University of Connecticut

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341 Mansfield Road, Unit 1063
Storrs, CT 06269–1063
Phone: (860) 486–3022
Fax: (860) 486–4463
http://www.econ.uconn.edu/

Abstract

Conventional tort law bars victims of exposure to a toxic substance from filing suit until they actually develop symptoms of illness. Practically speaking, this rule often bars recovery due to bankruptcy and causal uncertainty. One solution is to allow victims to file at exposure for expected damages (a tort for risk). The trade-off is that such a rule may trigger a race to file among exposure victims, thereby itself inducing bankruptcy. This paper characterizes the conditions under which such a race will occur in equilibrium and examines the implications for social welfare.

Journal of Economic Literature Classification: K13, K32, Q27

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A Tort for Risk and Endogenous Bankruptcy

1. Introduction

Environmental accidents often involve mass exposure to a toxic substance that creates (or increases) the risk of future illness. Examples include accidental chemical releases such as the one that occurred in Bhopal, India in 1984 (Fischer, 1996), nuclear accidents such as Three Mile Island and Chernobyl, and prolonged exposure to asbestos. Under traditional tort law, victims of such exposure cannot file damage claims until they actually develop symptoms of illness.[1] However, the long latency period of many illnesses, the difficulty of proving causation, and the possibility of injurer bankruptcy, all act as effective bars against recovery. Thus, some scholars have argued that victims should have the option to sue for expected damages at the time of exposure, in effect treating the exposure itself as a tort--what we will call a "tort for risk" (TFR) (Love, 1996).

Several previous authors have examined the tradeoffs involved in allowing a tort for risk.[2] A key concern is the impact on litigation costs. While Robinson (1985) has argued that allowing a tort for risk would drastically increase the number of lawsuits and hence total litigation costs, advocates suggest an offsetting deterrence benefit. In many toxic tort contexts, there is a long latency period between the time of exposure and the time a resulting disease is manifested. As a result, requiring victims to wait until the time of illness to file suit could actually bar victims from receiving any compensation if the

[1] See Keeton, et al. (1984), §30, p. 165. In some jurisdictions, victims can sue for emotional distress and/or the costs of medical monitoring (Valk, 1995; Miceli and Segerson, forthcoming).

injurer is insolvent or judgment-proof at the time the disease is contracted, or if the victim cannot establish a causal connection between her illness and the injurer's actions (Shavell, 1985). This affects both the extent of victim compensation and the injurer's incentive to take care to reduce the magnitude or likelihood of exposure. While victim compensation is primarily a distributional issue,[3] increased injurer care affects the expected damages from exposure and hence social welfare.

The concern about insolvency that underlies the above argument is based on an assumption that the risk that the injurer will be insolvent or judgment-proof at the time of illness is exogenous, i.e., driven by factors unrelated to liability. However, in large toxic tort cases where total liability can be large relative to a firm's assets, it is also possible for the liability itself to trigger bankruptcy if the firm has insufficient assets to cover the liability-related claims against it. A well-known example is the bankruptcy of the Johns-Manville Sales Corporation, which was triggered by the costs stemming from asbestos litigation (Note, 1983). This possibility raises an additional concern about allowing a tort for risk, namely, that it might drive a firm into bankruptcy when a traditional rule of only allowing suits at the time of illness would not have. Bankruptcy can entail a loss of social welfare (i.e., a reduction in economic efficiency), if it implies that an activity that on balance is socially beneficial (i.e., that makes an expected net positive contribution to social welfare) cannot be undertaken. This effect must be combined with the effect on litigation costs and deterrence to determine the overall impact on economic efficiency of allowing a tort for risk.

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[2] See, for example, Landes and Posner (1984), Robinson (1985), and Miceli and Segerson (2003b). Also, see the related analysis by Rose-Ackerman (1989).

[3] Victim compensation is a reallocation of wealth from injurers to victims. Ex post, this reallocation affects the distribution of welfare within society but not society's total welfare. Of course, to the extent that a

In this paper, we explore the relationship between a tort for risk and bankruptcy. Specifically, we ask whether the introduction of a tort for risk ever induces bankruptcy when it would not have occurred under the traditional rule. The reason that a tort for risk might increase the likelihood of bankruptcy is the possibility that victims will "race to file" at exposure for fear that the injurer will have insufficient assets later to pay actual damage claims.[4]

Our analysis of a race to file is related to other contexts in which a race to claim a firm's limited assets triggers bankruptcy. The classic example is a bank run, in which depositors rush to withdraw their assets from a bank because they expect other depositors to do the same and want to beat them to ensure a greater claim on the bank's limited assets (Diamond and Dybvig, 1983). In a litigation context, Spier (2002) examines settlement negotiations between a defendant and multiple plaintiffs whose collective damages (if they win at trial) exceed the defendant's assets. Both of these papers are related to our analysis, but focus on different issues. Diamond and Dybvig (1983) focus on the liquidity service provided by banks and the impact of runs on risk sharing among risk averse depositors, while Spier (2002) focuses on the settlement-trial decisions of the plaintiffs rather than on the timing of their filing decisions.

The paper is organized as follows. In Section 2 we discuss in more detail the impact of allowing a tort for risk on litigation costs and deterrence when bankruptcy is endogenous. This discussion draws heavily on the TFR model developed in Miceli and Segerson (2003b). In the context considered there, litigation costs play a key role in

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requirement of victim compensation causes injurers to invest more in prevention or care, it will indirectly affect social welfare.

[4] In this sense, bankruptcy is endogenous, whereas in most previous tort models it is treated as exogenous (Shavell, 1986; Miceli and Segerson, 2003a).

inducing a possible race to file. In addition, the results depend on the assumption that there are a large number of victims. This implies that each victim thinks her individual filing decision will not have a sufficiently large impact to trigger bankruptcy. In addition, under this assumption, once an exposure has occurred the injurer can reasonably assume that a given share of victims will actually contract the illness. In Section 3 we consider an alternative scenario. We abstract from litigation costs by assuming that they are zero and focus instead on the "small" numbers case. In this setting, an individual victim's filing decision can trigger bankruptcy. In addition, the injurer must consider the possibility that *all* exposure victims will contract the illness (the "worst case" scenario).[5] We develop a simple model to examine the filing equilibria under this scenario when a tort for risk is allowed. We again ask whether allowing a TFR will trigger a race to file and bankruptcy, thereby preventing the firm from continuing to produce a product or service that could potentially be socially beneficial. We first describe the basic model and the equilibrium under the traditional tort rule. We then derive the equilibrium under the TFR rule and compare it to the traditional rule in terms of efficiency and compensation of victims. Finally, Section 4 concludes.

2. The Large Numbers Case with Litigation Costs

2.1 The Basic Model without Bankruptcy

Consider a scenario in which a (potential) injurer engages in an activity that creates the possibility of an accidental exposure of a large population of victims to a

[5] While the worst case scenario is technically possible under the large number case as well, the probability that this will occur is sufficiently low when the number of exposure victims is high that the injurer can reasonably ignore it.

harmful substance.[6] The injurer can undertake activities that reduce the likelihood of an accident, but these activities are costly. If an exposure occurs, a given victim may or may not develop a related illness in the future. Let q be the probability that a victim ultimately develops the illness, which we assume results in losses equal to D dollars.[7] Assume that all victims suffer the same loss in the event of illness, but that the probability of developing the disease (q) varies across victims. In general, victims can be expected to differ in terms of the intensity of their exposure (e.g., the duration of exposure or the proximity to the point of release) and hence in their probabilities of contracting the illness. We assume that each victim's q is observable to the court so that it can calculate that victim's expected damages, qD, if necessary.

In terms of assessing liability on the injurer, we will consider two rules: the *traditional rule*, under which a victim can only seek damages in period two if she sustains an actual loss, and a *tort for risk* (TFR), under which a victim can sue in period one (immediately following exposure) for expected damages of qD. We assume throughout that liability is strict.[8] In this case, under the traditional rule, and in the absence of any bankruptcy consideration, exposure victims would be required to wait until they sustain actual damages before filing suit. If they ultimately contract the disease and file suit, they will receive a net return equal to their losses, D, less their litigation costs, denoted c_v. We assume that $D>c_v$, so that filing suit if and when the illness occurs would be profitable for all illness victims who expect to recover their full damages, yielding a net

[6] See Miceli and Segerson (2003b) for a detailed description and analysis of the issues discussed in this section.

[7] If the losses take the form of lost wages, then losses are measured directly in dollars. If, on the other hand, losses stem from non-monetary impairment, then D represents the monetary equivalent of those losses.

return of D-c_v. In contrast, if a tort for risk is allowed, some victims could choose to file at exposure instead. Victims who file at exposure would be able to recover only their expected losses, qD. We assume (for simplicity) that the victim's litigation costs are the same under the traditional rule and under the tort for risk. Then, the net return from filing at exposure would be qD-c_v.

Clearly, in the absence of bankruptcy, if there were no litigation costs ($c_v=0$), then exposure victims would be indifferent between filing at exposure and at illness, since both would yield the same expected return (qD).[9] However, with positive litigation costs ($c_v>0$), in the absence of bankruptcy all accident victims would prefer to wait rather than file at exposure since waiting yields a higher net return. Both options yield the same expected award (qD). However, if an exposure victim files suit at the time of exposure, she will incur litigation costs with certainty, while if she waits, she will incur these costs only if she contracts the disease. Thus, if there is no possibility of bankruptcy, allowing a tort for risk will have no impact on filing decision (i.e., the decision will be the same as under the traditional rule), and hence no impact on the number of suits (which determines total litigation costs) or deterrence. This result does not hold, however, if liability can bankrupt the injurer.

2.2 The Filing Decision with Potential Bankruptcy

When liability can bankrupt the injurer, then under a tort for risk the victim faces the following tradeoff in deciding whether to file at exposure or wait until the time of illness. If she waits, she will save on litigation costs (in expected terms), as in the case

[8] Thus, the injurer is liable for damages resulting from his activities, regardless of the level of care taken to prevent the accidental release. We do not consider negligence-based rules, under which an injurer would be liable only if he failed to meet the due standard of care.

[9] This assumes that victims are risk neutral. We also ignore discounting for simplicity.

without bankruptcy. This is the benefit of waiting. The cost of waiting is the potential reduction in the damage award if the injurer's assets have been reduced or depleted by other, earlier suits. Of course, this cost depends on the number of victims who choose to file early (at exposure). Note that, since the expected savings in litigation costs decreases with the probability that they will be incurred (i.e., the probability that the illness will occur), the advantage of waiting will be lower for victims who are more likely to contract the disease. Thus, the potential for bankruptcy creates a "threshold" result under which high-exposure victims (i.e., those with a higher value of q) choose to file at exposure while low-exposure victims choose to wait. The "cut-off" occurs at the exposure level that makes a victim indifferent between filing at exposure and waiting.

Does this threshold result imply that a race to file will ensue if victims are allowed to sue at exposure? The answer depends on the injurer's asset level. If the injurer would not have had sufficient assets to cover his expected liability-related costs even in the absence of a tort for risk, then allowing a tort for risk will trigger a race to file. At least some exposure victims (those with high exposure levels) will choose to file at exposure in an attempt to secure a larger share of the injurer's limited assets. However, the race will be partial, meaning that some exposure victims (those with low exposure levels) will choose to wait in the hope that they will not contract the illness and hence never have to incur the litigation costs associated with a suit. This implies that a tort for risk effectively creates a priority rule that gives high exposure victims first claim on the injurer's limited assets.

In contrast, if the injurer would have sufficient assets to cover the expected cost of all illness suits (and hence would not be bankrupted under a traditional rule), then a race

to file would not necessarily result if a tort for risk were allowed. If a victim does not expect other victims to file early, then she will have no incentive to file early either. However, if she expects others to file early, then she has an incentive to file early as well, and a race to file that results in bankruptcy can ensue. Thus, allowing a tort for risk can induce filing behavior that leads to bankruptcy when a traditional rule would not, although it is also possible that it will not affect filing behavior at all.

2.3 The Impact on Litigation Costs and Deterrence

What, then, are the implications of the effect on filing behavior for litigation costs and deterrence? Although a tort for risk induces some victims to file at exposure, it does not necessarily increase the total number of lawsuits (and hence total litigation costs). If exposure suits sufficiently reduce or exhaust the injurer's assets, then some illness victims will find suits at the time of illness unprofitable. Thus, while a tort for risk would allow exposure suits, if the injurer has a sufficiently low asset level it could decrease the number of illness suits and thus decrease the total number of suits as well.

The impact of filing on the injurer's choice of care depends on its impact on his expected liability-related costs. If allowing a tort for risk is expected to induce bankruptcy while the traditional rule would not, then the tort for risk will increase total expected costs for the injurer and hence provide the injurer with an incentive to increase his care level in an effort to reduce those costs. However, if the injurer would have faced bankruptcy under the traditional rule as well, then bankruptcy induced by allowing a tort for risk (albeit at an earlier date) would generate the same expected total costs for the injurer and hence the same incentives for care. Thus, while it is possible that allowing a tort for risk will increase care incentives, this outcome is not guaranteed.

The results summarized above regarding the impact of allowing a tort for risk were based on several assumptions: (1) that litigation costs are positive; (2) that there are a large number of victims so that any individual victim's filing decision cannot trigger bankruptcy, and injurers can reasonably predict the share of exposure victims who will actually contract the illness; and (3) that capital markets are perfect so that injurers can borrow against future earnings to pay current liability-related costs. This last assumption implies that whether or not bankruptcy occurs depends not on current assets but on the stream of assets over time. In practice, capital market imperfections may prevent inter-temporal borrowing against future assets, implying that bankruptcy occurs when current claims exceed current assets.

In the following section, we consider the implications of allowing a tort for risk under an alternative scenario, namely, where (i) the number of victims is small (hence injurer's face the real possibility that all victims would contract the disease, and a single victim's filing decision can trigger bankruptcy), and (ii) capital markets are imperfect so that bankruptcy occurs when current liability-related costs exceed current assets. The inability to borrow against future earnings implies that bankruptcy in an earlier period could reduce efficiency by preventing the injurer from engaging in a future activity that might be socially valuable. In order to focus on these two issues, we ignore litigation costs, which played a crucial role in the results derived above. In addition, to simplify the model, we assume that all victims face the same probability of contracting the illness if exposed, i.e., all have the same exposure intensity (same value of q). Thus, the threshold result discussed above (which hinged on differences in exposure intensity) no longer plays a role in the equilibrium. As before, we examine the equilibrium filing

strategy for the victims, and its implications for bankruptcy and the existence of a race to file. Because litigation costs are assumed to be zero, we do not consider the impact of a tort for risk on total litigation costs. Likewise, we do not consider the implications for injurer care, since they would follow closely the principles driving the deterrence effects under the previous scenario.

3. The Small Numbers Case with Imperfect Capital Markets

3.1 The Basic Model

For simplicity, we consider a model with two periods and two victims. At the start of the first period the two victims are exposed to a toxic substance. As a result, both face a probability q of becoming ill in the second period ($0<q<1$), in which case they will sustain damages of D dollars. Thus, their expected damages as of period one are qD. The injurer has A_1 assets in period one with which to pay damages, and if it remains in business in period two, it will generate an additional A_2 in assets (net profit).[10] However, if the injurer goes bankrupt in period one, it will not realize the A_2 assets. Thus, we can think of the foregone period two assets as the efficiency cost of bankruptcy. (Since the model is limited to two periods, bankruptcy in period two has no efficiency effects.)

As before, we consider two possible liability rules, the traditional rule and a tort for risk. Under both rules, we assume that filing suit is costless and continue to assume that liability is strict. If the injurer is bankrupted in either period as a result of lawsuits, its remaining assets are fully distributed (in equal shares if there are multiple plaintiffs). As noted, we assume that capital market imperfections prevent the injurer from borrowing in period one against its expected period two assets.

[10] We assume that only net profits are available to pay damages. Thus, for example, input suppliers have a prior claim on the injurer's revenues compared to victims.

Finally, to make the model interesting, we assume that a single victim filing a TFR suit in period one cannot bankrupt the injurer. However, if both victims file in period one, the injurer will be bankrupted. Thus,

$$qD < A_1 < 2qD. \tag{1}$$

This assumption isolates the effect of the joint decisions of the victims on the injurer's solvency. (Specifically, only a "race to file" will bankrupt the injurer in period one.) We do not, however, place any *a priori* restrictions on the magnitude of A_2. Thus, we characterize the equilibrium behavior of victims for different values of A_2, or equivalently, for different values of total assets, $A \equiv A_1 + A_2$, given (1).

3.2 Equilibrium under the Traditional Rule

We first consider the outcome under the traditional rule. Here, the only decision of victims is whether or not to file in period two if they become ill. Since filing is costless and liability is strict, they will always do so. Thus, the injurer faces the following possible period-two outcomes: (1) neither victim becomes ill, which occurs with probability $(1-q)^2$; (2) one victim becomes ill, which occurs with probability $2q(1-q)$; and (3) both victims become ill, which occurs with probability q^2. Summing the damages in each case weighted by the probabilities yields expected damages as of period one equal to $2qD$. Thus, if the injurer's total assets over the two periods are such that $A > 2qD$, then it is solvent in an expected sense since its total assets exceed its expected liability. The injurer may nevertheless go bankrupt in actual terms, depending on its total assets and which of the above outcomes actually occurs. Although bankruptcy in this

case has no efficiency effects, it may limit the injurer's ability to compensate victims who become ill, a purely distributional concern.[11]

The possible cases are as follows:

$A > 2D$,	the firm is never bankrupt;	(2.1)
$D < A < 2D$,	the firm is bankrupt only if both victims become ill;	(2.2)
$A < D$,	the firm is bankrupt if one or both victims become ill.	(2.3)

In the next section, we compare these outcomes to those that can occur under the TFR rule.

3.3 Equilibria under the Tort for Risk Rule

Under a TFR, an exposure victim can file in period one for damages of qD, or wait until she becomes ill in period two and file for D. The two victims make their filing decisions simultaneously and either choose to file "now" (at exposure) or "wait" to file until they actually become ill. Thus, there are four possible outcomes: (wait, wait), (now, wait), (wait, now), and (now, now). The outcome where both wait corresponds to the traditional rule, while the other three involve a TFR suit by at least one victim. It is easy to show that the injurer's expected liability under each outcome is $2qD$, which is the same as under the traditional rule. Thus, absent the threat of bankruptcy, the two rules are equivalent in expected terms. As before, however, the *actual* outcomes in each case involve different amounts of liability, and may lead to bankruptcy, depending on the injurer's assets. This can lead to different outcomes under the two rules.

[11] Obviously, if deterrence of the original exposure were an issue, an inability to fully compensate victims in either period would have efficiency effects due to the judgment proof problem.

If both victims wait, they behave identically under the TFR and the traditional rule, and the possible outcomes are those described in (2). If one victim files at exposure and the other waits, the following two outcomes are possible:

$A > (q+1)D$, the firm is never bankrupt; (3.1)

$A < (q+1)D$, the firm is bankrupt in period two if the victim who waits becomes ill. (3.2)

As under the traditional rule, only period-two bankruptcy is possible in this case, which, as noted, has purely distributional implications. Finally, if both victims file at exposure, the injurer is bankrupted in period one, given $A_1<2qD$. This last case (the race to file) is especially interesting because it is the only one in which bankruptcy in period one occurs, producing an efficiency loss (failure to realize A_2), as well as possible distributional effects.

In order to derive the equilibrium outcomes under a TFR, consider the normal form of the victims' filing game as shown in Figure 1. (The first payoff in each cell is for victim one, and the second is for victim two.) Given that $A_1<2qD$, if both victims choose to file now, the injurer goes bankrupt in period one and each victim receives half of his first period assets, or $A_1/2$. If one victim files now and the other waits, the one filing now gets qD (since $A_1>qD$), while the other has an expected payoff of $qD-x$, where $x=0$ if the injurer has enough assets in period two to pay the victim's damages if she becomes ill, and $x>0$ if it does not. Finally, if both victims wait to file, each has an expected payoff of $qD-y$, where $y=0$ if the injurer's assets are expected to cover its total liability and $y>0$ if not. Obviously, the equilibrium of the filing game depends on the specific magnitudes of x and y, which in turn depend on A. We consider several cases.

Case 1: $A \geq 2D$. In this case, the injurer is never bankrupted by liability, even in the worst case ("catastrophic") scenario where both victims wait to file suit and both become ill. Thus, $x=y=0$, and there are three pure strategy equilibria of the filing game: {(wait, wait), (now, wait), (wait, now)}.[12] In addition, there are an infinite number of mixed strategy equilibria where one player plays the pure strategy "wait" and the other randomizes between the two strategies with an arbitrary probability.[13] Under all of these equilibria, both victims are fully compensated (either in actual terms if they wait, or in expected terms if they file a TFR suit), and the injurer remains in business for both periods. Thus, the equilibria are also efficient in the sense that the injurer realizes its period-two assets. In this case, there is no effective difference between the traditional and TFR rules (except that some victims are compensated in expected terms and others in actual terms).[14]

Case 2: $(q+1)D \leq A < 2D$. In this case, the injurer is only bankrupted if both victims wait to file and both become ill, in which case each receives half of the injurer's total assets, or $A/2$. Thus, if both wait, each has an expected payoff of

$$q(1-q)D + q^2(A/2) = qD - q^2[D-(A/2)],$$

which implies

$$y = q^2[D-(A/2)] > 0. \qquad (4)$$

However, if only one victim waits and becomes ill the injurer can cover the liability. Thus, $x=0$.

[12] In the two pure strategy equilibria where one victim files now and one waits, there is nothing in the model to determine which victim adopts which strategy. In the case where victims differ in their risk of developing illness (i.e., they differ in their values of q) and litigation is costly, we showed above that victims with lower risk wait to file while those with higher risk file at exposure.

[13] If we let $p_i \in [0,1]$ be the probability that player i files now, then the reaction functions for the two players coincide with the axes of the unit square in (p_1,p_2) space.

In this case, there are two pure strategy equilibria of the filing game: {(now, wait), (wait, now)}, and one mixed strategy equilibrium where each player files now with probability

$$p^* = \frac{y}{y + (qD - (A_1 / 2))}, \tag{5}$$

and waits with the complementary probability.[15] Note that all of these equilibria are efficient in the sense that the injurer is never bankrupted in period one. However, there is an important distributional difference between the pure strategy equilibria and the mixed strategy equilibrium. In the former, victims are fully compensated because the injurer is not bankrupted in either period (as in Case 1). In contrast, under the mixed strategy equilibrium both victims may end up waiting to file in period two, and if both become ill, the injurer is bankrupted. Thus, although the equilibria are all efficient (because only period two bankruptcy is possible), the pure strategy equilibria are preferable to the mixed strategy equilibrium because they guarantee full compensation of both victims.

Intuitively, the pure strategy equilibria avoid bankruptcy by allowing the injurer to pay expected damages of qD to one victim in period one with certainty, thereby leaving it with enough assets in period two to pay actual damages of D should the other victim become ill. Interestingly, to the extent that the pure strategy equilibria are expected to emerge in this case, the TFR rule actually lowers the risk of bankruptcy compared to the traditional rule under which period two bankruptcy is always possible when $A<2D$.

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[14] If a victim who receives expected damages uses it to buy market insurance against a future loss, then she will receive compensation for her actual loss in the event of illness.

[15] Note that p^* is strictly between zero and one given $y>0$ in this case and (1). In this case, the reaction functions intersect at three points in (p_1,p_2) space: (1,0), (0,1), and (p^*,p^*).

Case 3: $(A_1/2q)+qD< A< (q+1)D$. In this case, the injurer goes bankrupt in period two if even one victim waits to file and becomes ill. Thus, the expected payoff from waiting to file, given that the other victim files now, is

$$q(A-qD) = qD - q[(q+1)D-A].$$

It follows that

$$x = q[(q+1)D-A] >0, \tag{6}$$

while y continues to be given by (4). Although $x>0$, the types of equilibria in this case are the same as in Case 2 if $qD-x>(A_1/2)$, or, substituting from (6), if

$$(A_1/2q)+qD < A, \tag{7}$$

which defines the lower bound on A in this case. Thus, there are again two pure strategy equilibria: {(now, wait), (wait, now)}, and a single mixed strategy equilibrium where each player files now with probability

$$p^* = \frac{y}{y+[(qD-x)-(A_1/2)]}. \tag{8}$$

As in Case 2, the equilibria are all efficient in the sense that the firm is never bankrupted in period one, but in contrast to Case 2, even the pure strategy equilibria in this case result in period two bankruptcy if the victim who waits becomes ill. Thus, the victim who files suit at exposure is assured full compensation (in expected terms), while the one who waits is undercompensated if he becomes ill. In comparison, if period two bankruptcy occurs under the traditional rule (cases (2.2) and (2.3)), any victims who become ill are undercompensated.

Case 4: $A=(A_1/2q)+qD$. In this case, if one victim files now, the other victim is indifferent between waiting and filing now (i.e., $qD-x=(A_1/2)$). As a result, there are three pure strategy equilibria: {(now, wait), (wait, now), (now, now)}, and an infinite

number of mixed strategy equilibria where one player plays the pure strategy "now" and the other randomizes between the two strategies with an arbitrary probability. (This case thus mirrors Case 1.)[16] The injurer is bankrupted in period two if one party waits and becomes ill (as in Case 3), and is bankrupted in period one if both file now. This therefore represents the first case in which period one bankruptcy can occur as a result of a "race to file." If it does, it not only leaves victims undercompensated (even in expected terms), it is also inefficient in that the injurer does not realize his period two assets. In this case, the TFR rule is welfare-reducing and is also inferior to the traditional rule in terms of compensation.

Case 5: $A<(A_1/2q)+qD$. In this case, victims strictly prefer to file now, regardless of the other victim's choice. Thus, (now, now) is a dominant strategy, and a race to file is the only equilibrium. Again, the TFR is inferior to the traditional rule, both in terms of efficiency and compensation of victims.

To summarize, the preceding cases have shown that the equilibrium impact of a TFR rule varies depending on the level of the injurer's inter-temporal assets. This dependence is depicted graphically in Figure 2, which shows the regions where each case is relevant in (A_2, A_1) space. When total assets are sufficiently large (case 1), the TFR has no real effect either in terms of efficiency or compensation of victims. For intermediate asset levels (cases 2 and 3), the TFR has no efficiency effect, and it may actually increase the ability of injurers to compensate victims by allowing them to pay expected damages up front to some victims and possibly to avoid period two bankruptcy. However, for sufficiently low asset levels (cases 4 and 5), a TFR potentially has detrimental effects on

[16] That is, the reaction functions coincide with the outer edges of the unit square in (p_1,p_2) space.

both efficiency and compensation by possibly triggering a "race to file" among victims that bankrupts the firm prematurely.

4. Conclusion

Conventional tort law bars victims of exposure to a toxic substance from filing suit for damages until they actually become ill. This rule often has the practical effect, however, of denying victims compensation because, by the time the illness arises, the injurer may have gone bankrupt for reasons unrelated to liability. A possible solution to this problem is to allow victims to file at exposure--that is, to create a tort for risk. The tradeoff is that this rule may trigger a race to file among exposure victims (who fear future bankruptcy), thereby itself inducing bankruptcy.

Our comparison of a tort for risk with the traditional rule under both scenarios we considered showed that a race to file can indeed arise in equilibrium under certain conditions, particularly for firms that have relatively low inter-temporal asset streams. If the injurer's asset level is sufficiently high that there is no threat of bankruptcy, then allowing a tort for risk will have no effect on filing behavior since there will be no incentive for victims to file early. Thus, the impact of allowing a tort for risk stems from the possibility of bankruptcy.

The filing behavior induced by allowing a tort for risk can have several implications. First, when a firm's total assets are sufficiently low, it can actually trigger bankruptcy (perhaps pre-maturely), implying that bankruptcy is endogenously determined by the liability rule. Such an outcome is undesirable, both because it can be inefficient (if it prevents a future activity that is socially beneficial), and because it may leave victims under-compensated. However, for healthier firms, the rule may actually

have the desirable effect of staving off bankruptcy from future tort suits by allowing the firm to pay some of its liability in expected terms, thereby leaving it enough assets to pay any future illness claims in full. In this way, the rule functions like liability insurance for firms.

Second, allowing a tort for risk can affect the total number of suits brought by victims. However, the results of Section 2 imply that the impact on litigation costs is unclear. In some cases, total litigation costs could increase, while in others they might decrease. *Ceteris paribus*, litigation costs are more likely to increase under a tort for risk when the injurer's asset level is high (but the threat of bankruptcy still exists).

Finally, if allowing a tort for risk increases total expected liability-related costs, it can also increase the injurer's incentives to take care. This can occur if the tort for risk triggers bankruptcy when it would not have occurred under the traditional rule. However, it is also possible that allowing a tort for risk will actually lower the injurer's risk of bankruptcy compared to the traditional rule.

These conclusions suggest that, in addition to affecting both the amount and the nature of victim compensation, a tort for risk can have several welfare effects, which can work in opposite directions. Thus, taken together, the results from Sections 2 and 3 imply that the welfare impacts of allowing a tort for risk are ambiguous, and likely to depend on the injurer's asset level.

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		Victim 2: Now	Victim 2: Wait
Victim 1	Now	$A_1/2,\ A_1/2$	$qD,\ qD-x$
	Wait	$qD-x,\ qD$	$qD-y, qD-y$

Figure 1. Victims' filing game, normal form.

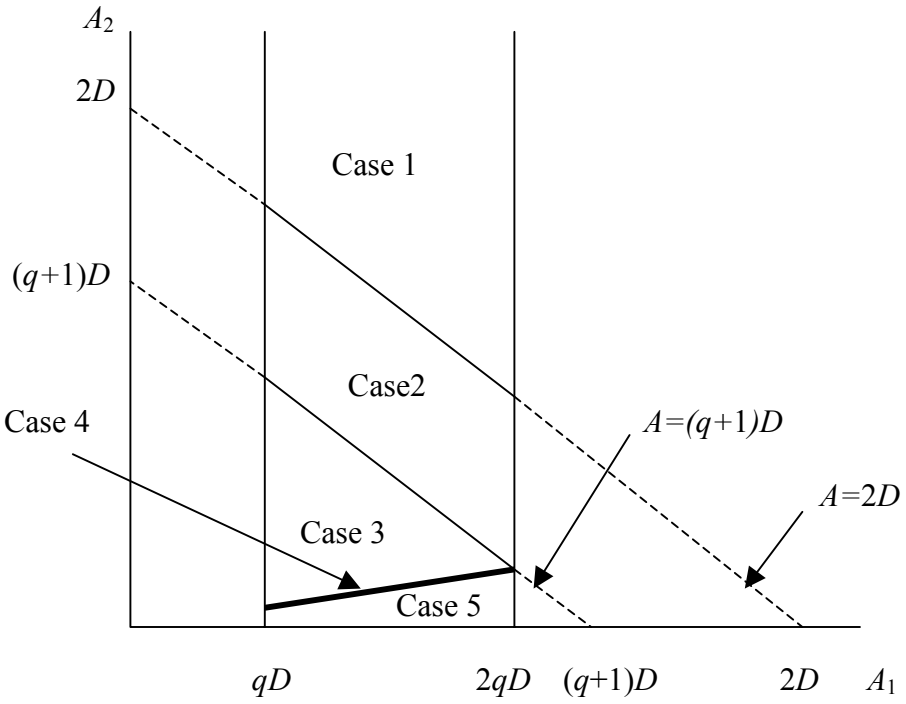

Figure 2. Regions where various equilibria exist.